

THE INTELLIGENCE OF PLUMBING

We are crowded into the kitchen of a small apartment. The tenant, a young woman bouncing a baby on her knee, sits by the back door watching us. Mr. Guthier, Terry, and two other boys are squatting down looking under the sink. The base of the sink is enclosed within a cabinet, so access is restricted. There is an old pan under the curve of the p-trap; it catches one of the leaks Mr. Guthier and his students will fix. A section of the pipe has been replaced, and dried glue of some kind covers the seam in uneven globs. About three-quarters of the pipe, from the sink to the p-trap, is wound in black tape. I am kneeling next to Terry, seventeen, two days' beard, slight nose, a scar across his extended hand. Like the young hairstylists we just met, Terry is at an important point in his development—but for him, an opportunity or a disruption could have huge consequences.

Terry, like most of the boys in this room, is in a special program for young people who have a history of drug abuse and a consequent history with the juvenile justice system. The program enables them, as part of their probation, to finish high school in a curriculum that will provide a general education and entry-level competence in one or more of the construction trades. Though most of the boys have mediocre to poor school records, a number of them take to the program, seeing it as a way out of a bad situation. They throw their considerable energy into the work, running

back and forth for supplies, taking stairs two at a time, curling themselves around and under sink cabinets, toilets, the underbellies of old houses. As one boy announces to his classmates after a successful toilet installation: "Hey, this ain't that hard. I could do this for a living."

I met Mr. Guthier and his students during my visits to Metro-Tech, a vocational high school in Phoenix, Arizona, that is making the transition to an integrated academic-vocational curriculum. This particular program is one of a number of efforts these days to create surer pathways from school to work. The emphasis in much of what is said and written about such programs is on the economic benefits to student and society. And there is also a critical literature, skeptical about linking education so closely to the job market. I'll say more about these issues in a subsequent chapter on vocational education, but for now I want to consider a set of issues less discussed in the school-to-work debates, but important to the themes of this book: work as a vehicle for human relation, the importance of adult mentors in the development of competence, and the continual play of intelligence in that relationship and development. Along with the story of Terry and his peers learning a trade, and the story of their rehabilitation, there is a story here about mind and the pivotal role of human connection.

Field experience is essential to Jon Guthier's teaching, and one way he secures such experience for his students is through an arrangement with the city to do free repairs on low-income housing. Repair work, especially on older or less expensive homes and apartments, offers important challenges for young plumbers that they won't get doing new construction. Materials are not always standard; there are unusual structures, nooks, crannies, surprises within the wall; there is often a series of past repairs, layered one over the other, often makeshift. In a sense, such occasions take the

students back to a time before codes and prefabrication. They will need to develop a certain resourcefulness and a problem-solving orientation to things.

"What do you make of this, boys?" asks Mr. Guthier, pointing to the taped pipe. "Looks like a mess," says Terry. "Yep," says the teacher. "What do you think we should do with it?" "We gotta replace it," says one boy. "Well, sure," says Mr. Guthier, "but how, where . . . how do we start?"

Jon Guthier is a slight man, about 5'7", 135 pounds, with thin muscled arms, long brown hair, and glasses. At forty-seven, he's worked plenty of construction-related jobs, has been a journeyman plumber and gas fitter for a number of years, and has been teaching for the last twelve. A photograph of him might suggest severity of manner—his features are sharp, angular, and weathered from all those years outdoors—but he has an easygoing way about him, a how's-it-going loquaciousness. The kids call him "Mr. G," or just "G." And they respect him, his concern for them, and his expertise. He's been there, has done the work, knows what he's talking about. So they consult him frequently—he's on the run at a job site from one kid to another—and they take his questions seriously. He poses questions often. When he and a class return to a job site, he'll begin the day by asking the students to go over the problems they had the day before and, as a consequence, to list the things they'll need to do today. When they confront a new job—replacing a toilet, fixing a leak—he asks what they'd do and why. Terry takes his question about that pipe under the sink and suggests they strip the tape to get to the nut attaching the drainpipe to the p-trap. That's reasonable, says Mr. Guthier, and with his right hand guiding their gaze over the entire structure asks the boys to consider what might happen as you take a wrench to that nut, given that other sections of the pipe, p-trap, and wall fixture are glued and,

most likely, rusted. Terry gets it: "You've gotta be careful. If that nut won't turn, you might tear something else loose."

The interconnection of the component parts of a structure is an obvious notion. But to grasp the meaning of that interconnection for your own action, and to realize that what you do can extend across different kinds of materials, and can be close by or at some distance—such understanding can give rise to deliberation. A stop-and-think orientation. I recall an experienced plumber, facing a somewhat more complicated situation of this type, telling me, "It's as important to say 'no' [to a possible course of action] as to say 'yes.' You can get yourself in real trouble if you don't think it through."

Mr. Guthier is moving his students toward the comprehension of a house as a complex system of materials, processes, and forces: not an obvious way to think about a building. And his questioning serves a further purpose: to help students become systematic in their approach to repair. The good plumber has a diagnostic frame of mind, evident in a manual that Mr. Guthier uses during classroom instruction. The manual is organized by problems—for example, "a valve or faucet does not completely stop water flow"—that are followed by lists of possible causes. Students are required to consider and test each possibility in turn: a kind of plumber's differential diagnosis. Could it be a bad washer? How about foreign matter—rust, grit—caught in the valve?

To think this way, Mr. Guthier explains to me, you need "to know how a thing is put together," how a device, or a category of devices, works. You may not be familiar with a particular brand of a valve, but if you can determine whether it's a cartridge valve or a compression valve, then you'll know something generally about its components and how they function. Then you're able "to go through these steps in your mind." Given the huge variety of

devices and structures you'll encounter in any group of old houses, you need to be able to operate in some systematic way. As they get more adept, these young plumbers may abbreviate the steps, zeroing in on a key feature of the problem rather than ticking off each item on a checklist. But for now I want to dwell on the development of these students' skill and their teacher's desire that they become both knowledgeable about the way things are constructed and systematic in the way they use that knowledge.

In this regard, it would be worth considering how Jon Guthier functions as mentor, as guiding adult, given his students' legal situation. "You feel that sense of urgency in them," he observes, "because even as things go well, something could fall apart right at the end." Though he does have heart-to-heart conversations with these boys about their behavior, the direction of their lives, and particular ethical dilemmas they face, a significant dimension of his mentoring role is played out through the work itself. Some of the teachers I've observed while writing this book tend toward the moral lecture, the lesson-on-life delivered from the front of the classroom. These, as best as I can tell, have little effect—did many of us respond well to them? Yet, as Mr. Guthier pointed out, there is great need here for guidance and structure. "When children feel that adults cannot or will not protect them," writes youth activist Geoffrey Canada in *Fist, Stick, Knife, Gun*, "they devise ways of protecting themselves." Yet, despite their hard-nosed bravado, most of these kids' lives are chaotic. Think, then, of what a guided participation in the work provides: structure and routine, to be sure, and a meaningful connection to an adult, and a sense of helping people out by repairing their homes. There is also, I believe, an ethical dimension to the way Mr. G encourages the young people in his charge toward a skillful and systematic encounter with the material world, toward an understanding that yields agency.

Several days after the students were pondering that taped drain-

pipe, Terry and a big kid named Ken are replacing a toilet in an old house. Terry has more experience at this task than Ken, so Mr. Guthier tells Ken to do most of the installation and asks Terry to observe and help out.

Installing a toilet is a pretty straightforward procedure, but replacing one, especially in an older house, can have its moments: removing the old toilet, negotiating tight space, fitting a newer model into the existing confines and fittings. One decision that has to be made concerns the flange, the collar that fits over the drainpipe in the floor, and onto which the toilet itself is attached. There's some ambiguity here, but you try to determine how corroded the existing flange is, whether or not it'll hold new bolts, will they be stable?

As soon as the boys remove the old toilet, Mr. Guthier asks them what they think of the flange. There's a quick exchange, then Mr. Guthier hears someone calling him from the kitchen and excuses himself. "I'm not sure," he says, exiting, "but I think you might want to replace it. You don't want to take a chance on a callback."

Ken and Terry settle in, Ken getting down close to the flange, inspecting it. Terry asks, "How's it lookin' to you, Ken?" Ken scrapes at the edge of the flange with a screwdriver. "It looks OK," he answers and cocks his head to get a better take on the edges. Then he slips in two new bolts. "The bolts are going in nice and strong." Pause. "I think we can keep it. Go get G." Terry retrieves Mr. Guthier; the boys explain what they've done and their conclusion. "Well," he says, "you might be right."

Not everything Terry and Ken say during this installation, God knows, surely not everything, is so dialogic and problem-focused. But the installation proceeds effectively, and, at several junctures, is characterized by this kind of thoughtful activity. The boys' decision does not take the easy path of agreement, which suggests that

they're appropriating the diagnostic frame of mind modeled by Jon Guthier. They don't simply follow a routine, but vary it purposefully in response to their testing of the materials before them.

As I spend time with these young people, I'm struck by the way that Mr. Guthier's program not only allows them to find a temporary balance within chaos but, as well, becomes a means for them to achieve what they, for a variety of reasons—some beyond their control, some of their own making—could not achieve in the standard classroom. Their work with Jon Guthier exposes and nurtures their intelligence, becomes a measure of what they can do when they put their minds to it. Their teacher realizes acutely the legal and existential fix the boys are in, but addresses it, so to speak, through their engagement with tools and fixtures, water and pipe and surrounding structures.

I find myself thinking, too, of the imperfect bargain here. There is a long tradition in the United States—dating back to nineteenth-century reform schools—of trying to redeem wayward children through the industrial arts. This tradition often brought with it assumptions not only about the moral benefits of physical work but also about the intellectual capacity of working-class, urban youth. Jon Guthier's program, then, is embedded in a complicated history—one he works within, but modifies. It is blue-collar work that is offered to these boys—wealthy kids in trouble would have many more options—but Mr. Guthier takes it seriously and makes it substantial. (Historically, programs of this type frequently involved low-level and limiting tasks.) And from what I could discern of Terry and his peers' point of view, the plumber's trade provides one of the most unambiguous pathways they'd yet seen toward stability.

The huge question—one Jon Guthier frets over—is what will happen to the boys once they complete the program? What social and occupational mechanisms will be in place to forward their

development? There's a crucial public policy question here, one frightful to ask in these times of backlash against the less fortunate. What opportunities exist for the kind of technical and human engagement this program provides, and how deeply does the nation believe in its value?

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Dwayne, the fellow who announced that he could install toilets for a living, sits amid a group of boys on the bus, headphones on, singing along loudly to a Twista cassette, which, of course, we can't hear, and are left, instead, with Dwayne's assured but not very capable falsetto. Several of the boys around him, Denzell particularly, complain, questioning his talents, but Dwayne, a mix of nonchalance and confrontation, throws it right back, praising the quality of his own voice. Then back to song and complaint. Finally, Mr. Guthier, looking up into the rearview mirror, asks if everyone could please cool it, and they do, at least for a few blocks.

Dwayne will not let you miss him for long. He's boastful, funny, quick-witted, out on you for a response or a cigarette, charming in a boyish, street-smart way. With older men his demeanor shifts—he's still working you, but the quality of the interaction changes—there's more accommodation, and more need and request. Dwayne generates so much activity in the immediate space surrounding him—a flurry of word and gesture—that it's easy to miss, I certainly did, his considerable promise as a tradesperson. Mr. Guthier calls him "a quick study" and thinks he's the most competent student in the class.

If you hang around Dwayne at a job site, you'll witness, more than a few times, an event like this: Dwayne and another boy are finishing the installation of a toilet, and are hooking up the braided hose that brings water from the wall outlet—called an angle stop—to the tank. As they tighten the nuts, Dwayne cradles the hose in a

certain way to keep it from twisting and kinking. A few minutes later, Mr. Guthier comes in to remind the boys to be careful that the hose doesn't kink on you—but Dwayne had anticipated that, having already acquired the proper trick of the trade from Mr. G. Here's another: Dwayne is assisting Denzell as he replaces a showerhead. Denzell tightens the head and tries it. It leaks. He tightens it further. The head still leaks. "I bet you don't have the washer in right," suggests Dwayne. Upon disassembly Dwayne turned out to be correct.

Dwayne's advice to Denzell came amid a narrative about a confrontation with some guy at a girl's house, whereupon Dwayne conducted himself mightily, deftly . . . and, then, *bip*—tune out and you'll miss it—there's the hunch about the washer. Settle in with Dwayne long enough, and you begin to see: Dwayne leaning in to inspect a faucet or a flange, feeling carefully with an index finger to confirm what he sees; ticking off, amid chatter, the steps needed to test a fixture; recalling a solution to a similar problem solved in another house, another time.

Dwayne is demonstrating the development of what Jon Guthier calls "a kind of a library" of mechanical knowledge: knowledge of types of devices, how they're put together, how to work with them, processes to follow. This blend of learned facts, experiences, and procedures makes Dwayne capable of functioning without close supervision. The relation of learning and independent action.

To consider action, though, one has to consider factors beyond knowledge alone. To continue with Jon Guthier's metaphor, the tradesperson's library contains more than books; there's a feel and mood to the place, a history, traditions, practices. The skillful tradesperson is defined by what he or she knows, but, as well, by the quality of the work that knowledge yields. Dwayne and two other boys are installing a toilet. They have removed the old unit, and while one is replacing the angle stop on the wall, another is

quickly scraping the residue of the previous assembly from the floor. Then they put in a new flange, tap it into place, insert the bolts onto which the new toilet will rest, measure the distance of each bolt from the wall ($13\frac{1}{2}$ inches) to check alignment, place a donut of bowl wax over the flange (this protects against leaking), settle the new toilet onto the bolts, and measure again. These three boys work well together, dividing tasks yet assisting each other, efficient, assured. While they finish the installation, they talk about employment, jobs this training might enable them to get.

The final step is to apply caulking along the base of the toilet. Dwayne cleans up and dries off the floor, then reaches for the caulking gun and begins laying a neat strip of caulk around the porcelain. The caulk smells like pungent bananas—chemical and fruity—and another boy follows Dwayne's trail with a gloved forefinger, narrowing the line. Finished, Dwayne takes a small sponge and further trims the caulking, a thin line now at the base of the toilet. He stands up: "A few good flushes, and we're done." It does look good. Clean and tidy. As the other boys pick up tools and leave to reassemble with Mr. Guthier, I compliment Dwayne, who has fallen quiet. He breaks into a full smile. "Why, thank you very much," he says.

This moment clarifies in my notes like a snapshot. How much comes together to account for it, a developmental integration. The increasing dexterity with tools. Knowledge of plumbing devices and materials. A range of understandings about repair. Tricks of the trade. A systematic approach to problems. And there is the less measurable—but readily evident—sense of workmanship, the cluster of values that, one assumes, leads Dwayne both to check the distance of the toilet to the wall—an action with functional consequences for repair—and to take one more pass at the caulking to reduce it to a visually pleasing line, an aesthetic outcome.

A sense of workmanship is something that Mr. Guthier hopes

for. "I know these boys don't like to handle dirty toilets," he observes one day after we've returned to school, "so there's got to be something there that gives them pride in what they've been able to do." Some of the boys, he continues, "had very rarely been successful at things. Probably it's the first thing they've finished in a long time." If this is true, then one can only imagine the twinge of possibility they feel as they see something they made work, as they gain respect from adults whom they respect, as they begin to imagine—tentatively, anxiously—a different kind of life for themselves, fashioned through hand and brain.

And what might happen, I wonder, if we began to experiment with our own thinking about young people like Terry and Dwayne, and, more broadly, about the revelation of mind in the work they're doing. Jon Guthier's unexpected metaphor of the library can help us here and take us beyond the typical discussion of vocational students. How might it productively unsettle our thinking about intelligence, social class, and education to consider the foregoing account in terms of libraries and aesthetics, of differential diagnosis, of conceptualizing, planning, and problem solving, of the intimate connection between respectful human relation and cognitive display? My hope is that such shifts in perception would have consequences for the way we teach Terry and Dwayne, for the subsequent work we create for them, for how we talk to them and about them, and for the words we use to describe what they do.



A VOCABULARY OF CARPENTRY

From the Renaissance through the nineteenth century, mechanics and engineers developed a variety of picture books, charts, and model displays that classified and illustrated basic mechanisms and mechanical movements: gear assemblies, for example, or ratchets, or levers and pullies. (Diderot's *Encyclopedia* contains a number of such illustrations, and we see descendants of them in vocational textbooks and on wall displays in trade school classrooms.) Reading about the history of these mechanical aids, I was curious about the way mechanisms were classified and the role such illustrated classification might play in developing a visual storehouse of devices (think here of Jon Guthier's library). And I was captivated by the names given to these aids: "theaters of machines" and "mechanical alphabet." The mechanical alphabet, especially, got me to think further, beyond the models to the words and metaphors we use, how much we could benefit from a richer alphabet, a vocabulary broad enough to accurately render physical work.

Looking at the old plates, thinking in terms of alphabets, ways to spell and depict, I wonder how many aspects of workplace intelligent behavior are underappreciated, or go unnoticed, because our occupational vocabularies are reductive or because we don't have a category for such behaviors in standard measures of intelligence. What testing vocabulary do we have, for example, to discern the making of judgments from the feel of things, or the strategic use of tool and body, or the rhythmic spacing of tasks, or the